STATEMENT

I, Ryohei NAMBA, hereby state that I am competent in both the Japanese and English languages and that the attached English language document is an accurate translation of Japanese Patent Application No. 2002-315449.

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【List of Documents Attached】

【Name of Document】 Specification 1

【Name of Document】 Drawings 1

【Name of Document】 Abstract 1

【Request of Proof】 Yes

【Name of the Document】 Specification

【Title of the Invention】 Graft grasping device

【Scope of Claims】

【Claim 1】

A graft grasping device, comprising graft grasping means that grasps a graft in a lumen softly and includes a soft tubular member capable of expanding a diameter of the lumen easily, and suction force transmission means which communicates with the lumen of the graft grasping means, wherein while a graft is held in the lumen, a suction force transmitted from the suction force transmission means widely acts on an inside of the lumen.

【Claim 2】

A graft grasping device according to Claim 1, comprising:

a graft grasping member including a soft tubular grasping portion having a substantially C-shaped cross section and a slit in a longitudinal direction; and

a suction tube communicating with the lumen of the grasping portion and connected to a side wall of the grasping portion, wherein:

an inner wall of the grasping portion has at least a recessed portion including a communication portion with a lumen of the suction tube;

the recessed portion is covered with a sheet having a plurality of pores; and

a mesh sheet is existent in a space defined between the recessed

portion and the sheet.

【Claim 3】

A graft grasping device according to Claim 2, wherein the recessed portion is formed on the entire inner wall excluding portions adjacent to a distal end and a proximal end of the grasping portion and portions adjacent to the slit.

【Claim 4】

A graft grasping device according to any one of Claims 2 to 4, wherein the side wall of the grasping portion is provided with a grip.

【Claim 5】

A graft grasping device according to Claim 5, wherein the grip is connected to a suction tube connection portion provided on the side wall of the grasping portion concentrically to the suction tube.

【Claim 6】

A graft grasping device according to any one of Claims 2 to 6, wherein a connector is provided at a proximal end of the suction tube.

【Detailed Description of the Invention】

【0001】

【Technical Field to which the Invention belongs】

The present invention relates to a blood vessel grasping device. The blood vessel grasping device of the present invention can open

an anastomosing port for an anastomosing site without grasping a lumen of a blood vessel serving as a bypass by means of a pair of tweezers or the like, and is particularly suitable for coronary artery bypass grafting. The use of the blood vessel grasping device of the present invention allows bypass grafting to be carried out without causing damage to an intima of a blood vessel serving as a bypass.

【0002】

【Prior Art】

Currently, in order to treat ischemic heart diseases such as angina pectoris and myocardial infarct, percutaneous transluminal coronary angioplasty (PTCA) and coronary artery bypass grafting (CABG) are carried out. CABG is carried out on about 15,000 patients a year in Japan and on about 10 times more patients in Europe and the US.

CABG is a surgical operation for improving a blood flow by anastomosing a bypass material with a stenosed blood vessel, and a self blood vessel such as an internal thoracic artery or a large saphenous vein is mainly used as the bypass material. Then, at the time of operation, it is necessary to open an anastomosing port for an anastomosing site of a blood vessel serving as the bypass material, and conventionally a lumen of the self blood vessel is grasped with a pair of tweezers or the like. However, it is pointed out that the use of tweezers may cause damage to an intima. This

is probably because most of the tweezers or the like are made from hard materials such as metals and plastics and are provided with surface unevenness to prevent slipping and thus the portion of the blood vessel intima grasped with the pair of tweezers or the like is damaged. As a result, adhesion of a thrombus or hyperplasia of an intima remarkably occurs owing to the damage to the intima of the blood vessel serving as a bypass. Moreover, the possibility of causing restenosis is increased, thereby increasing a burden on the patient because a surgical operation needs to be performed again.

【0003】

【Problem to be solved by the Invention】

The present invention has been made in view of the above circumstances, and therefore an object of the present invention is to provide a blood vessel grasping device which is capable of opening an anastomosing port for an anastomosing site of a blood vessel serving as a bypass without causing damage to an intima.

【0004】

【Means for solving the Problem】

The inventors of the present invention have made extensive studies to solve the above problems. As a result, the inventors have found that, in order to maintain a state where an anastomosing port for an anastomosing site of a blood vessel serving as a bypass is opened without causing damage to an intima, it is sufficient

to open the anastomosing port by applying a suction force to an outer wall of the blood vessel, and have completed the present invention. That is, the present invention relates to a blood vessel grasping device, including: blood vessel grasping means that softly grasps a blood vessel in a lumen and includes a soft tubular member capable of easily expanding a diameter of the lumen; and suction force transmission means which communicates with the lumen of the blood vessel grasping means, in which a suction force transmitted from the suction force transmission means is widely spread to an inside of the lumen in a state where the blood vessel is held in the lumen. According to a specific example of a structure of the invention, the blood vessel grasping device includes: a blood vessel grasping member that includes a soft grasping portion having a longitudinal slit and a substantially C-shaped side cross section; and a suction tube which is connected to a side wall of the grasping portion and communicates with a lumen of the grasping portion, in which a part of an inner wall of the grasping portion includes at least a recessed portion including a communicating portion with a lumen of the suction tube, the recessed portion being covered with a sheet having multiple pores, and a mesh sheet is existent in a space defined between the recessed portion and the sheet.

【0005】

Here, in order to widely open an attachment port for attaching to an anastomosing site of a blood vessel serving as a bypass which

is grasped by the blood vessel grasping device, the recessed portion is preferably formed on the entire inner wall excluding portions adjacent to a distal end and a proximal end of the grasping portion and portions adjacent to the slit, in such a manner that the suction force from the suction tube acts on substantially the entire blood vessel serving as the bypass. The side wall of the grasping portion may be provided with a handle for ease of operation. The handle is preferably connected to a suction tube connection portion, which is provided on the side wall of the grasping portion, such that the handle is concentric with the suction tube. Furthermore, if required, a connector may be provided on the proximal end of the suction tube.

【0006】

【Carrying out the Invention】

Embodiments of the present invention will be described hereinbelow with reference to the accompanying drawings.

Fig. 1 is a front view of an embodiment of the present invention, Fig. 2 is a left side view of Fig. 1, Fig. 3 is an A-A cross sectional view of Fig. 1, Fig. 4 is an enlarged view of a main portion of Fig. 3, and Fig. 5 is an enlarged B-B cross sectional view of Fig. 2. In addition, Figs. 6 to 9 are diagrams for explaining CABG using the graft grasping device of the present invention.

As shown in Figs. 1 to 5, the graft grasping device of the present invention includes a graft grasping member 1 including a

soft tubular grasping portion 11 having a substantially C-shaped cross section and a suction tube 2 which communicates with a lumen 111 of the grasping portion 11 and is connected to a side wall of the grasping portion 11. A recessed portion 114 including at least a communication port 113 which communicates with a lumen 21 of the suction tube 2 and the lumen 111 of the grasping portion 11 is formed on an inner wall of the grasping portion 11. The recessed portion 114 is covered with a porous sheet 13 and a mesh sheet 14 is interposed between the recessed portion 114 and the porous sheet 13.

【0007】

As shown in Figs. 1 and 2, the graft grasping member 1 includes a grasping portion 11 which functions as graft grasping means. The grasping portion 11 is a soft tubular member having a slit 112 in the side wall in a longitudinal direction and has a lumen 111 for softly grasping a graft. The lumen 111 has a substantially C-shaped cross sectional form due to the formation of the slit 112. The grasping portion 11 can be easily expanded in a diameter by the slit 112 so that the graft can be detached from the grasping portion 11 by opening the slit 112 after the anastomosis of the graft.

A communication port 113 which is a communicating portion with the lumen 21 of the suction tube 2 is formed in the side wall of the grasping portion 11. The communication port 113 is provided with a suction tube connection portion 12 projecting from the side wall of the grasping portion 11. The suction tube connection portion

12 is connected to the suction tube 2. The suction tube connection portion 12 may be connected concentrically to a grip 3 around the suction tube 2 if necessary when a hand of an operator is hard to insert.

【0008】

The grasping portion 11 is generally a tubular member made from a soft flexible resin such as polyurethane, polyethylene or silicone. As shown in Figs. 3 to 5, a recessed portion 114 includes at least the communication port 113 of the inner wall of the grasping portion 11. The recessed portion 114 is covered with a porous sheet 13 having a plurality of pores 131 and a mesh sheet 14 is inserted into a space between the recessed portion 114 and the porous sheet 13. The length and inner diameter of the grasping portion 11 may be suitably selected according to the diameter of the graft to be used as a bypass. For example, the grasping portion 11 may have a length of about 10 mm and an inner diameter of about 5 mm.

It is preferable that the recessed portion 114 is formed large in order that the installation port of the bypass graft grasped by the graft grasping device to the anastomosing part opens large. It is preferably formed in the entire inner wall excluding portions 115 adjacent to the distal and proximal ends of the grasping portion 11 and portions 116 adjacent to the slit 112 so that the suction force of the suction tube 2 acts on substantially the entire graft.

The porous sheet 13 is adhered to the inner wall of the grasping

portion 11 with portions adjacent to the recessed portion 114 as a margin. In Figs. 4 and 5, the portions 115 adjacent to the distal and proximal ends of the grasping portion 11 and the portions 116 adjacent to the slit 112 serve as the margin. The number of the pores 131 is not particularly limited as long as the pores are uniformly distributed, and the suction force can be widely transmitted to the lumen 111 through the pores 131, but is suitably about 20 to 40. The material for the porous sheet 13 is not particularly limited if it can be adhered to the grasping portion 11 and is preferably the same as the material for the grasping portion 11.

The mesh sheet 14 is formed from a material which can adhere to the grasping portion 11 and may be adhered to the grasping portion 11 with stepped portions 117 formed adjacent to the margins 116 of the recessed portion 114 as the margin as shown in Figs. 4 and 5, for example. Alternatively, the mesh sheet 14 may not be adhered to the grasping portion 11 but may be existent in the space between the recessed portion 114 and the porous sheet 13. (in this case, the material therefor is not limited to the material for the grasping portion 11).

【0009】

When the graft is suction-grasped, there is a fear that the porous sheet 13 may be brought into close contact with the recessed portion 114 by a negative pressure generated between the lumen 111

and the porous sheet 13. In particular, when the porous sheet 13 is brought into close contact with the recessed portion 114 so as to fill up the communication port 113, there is a fear that, as the suction force is transmitted only through the pores 131 of the part of the porous sheet 13 corresponding to the communication port 113, a uniform suction force cannot be obtained and the anastomosing port (41 in Fig. 7) of the graft may not be opened. The mesh sheet 14 is means for preventing the porous sheet 13 from being brought into close contact with the recessed portion 114 directly and transmitting the suction force to the pores 131 of the porous sheet 13 other than the part corresponding to the communication port 113 through the mesh. According to the constitution including the recessed portion 114, the porous sheet 13, and the mesh sheet 14, while the graft (4 in Fig. 6) is held within the lumen 111 (not grasped yet), the suction force transmitted from the suction tube 2 widely acts on the inside of the lumen 111. That is, in this constitution, the wall of the lumen 111 of the grasping portion 11 is the inner surface of the porous sheet 13. While the graft (see 4 in Fig. 6) is held in the lumen 111, the suction force transmitted to the recessed portion 114 of the grasping portion 11 from the communication port 113 through the lumen 21 of the suction tube 2 widely acts on the inside of the lumen 111 through the mesh sheet 14 and the pores 131 of the porous sheet 13. Then, the graft is uniformly dilated by the transmitted suction force and adsorbed

to the inner surface of the porous sheet 13 and put into a state of being grasped to the grasping portion 11.

【0010】

The suction tube 2 is made from a flexible resin such as polyurethane, polyethylene, polyester, polypropylene, polyamide, soft polyvinyl chloride, fluororesin, or silicone. The distal end of the suction tube 2 is connected to the suction tube connection portion 12 of the graft grasping member 1 and the proximal end thereof is preferably provided with a connector 22 for connection to a suction device (not shown). A material for the connector 22 may be a synthetic resin such as polypropylene, ABS resin, polyvinyl chloride, polyethylene, polyethylene terephthalate, or polycarbonate.

【0011】

The graft grasping member 1 may be provided with the grip 3 on the side wall of the grasping portion to easily handle it. Since the suction tube connection portion 12 may be used as a grip, it cannot be said that the grip 3 is always necessary. However, for example, when it is difficult to insert an operator's hand, the grip is indispensable. The installation position and shape of the grip 3 are not particularly limited but the grip 3 is preferably formed in a tubular shape and connected to the suction tube connection portion 12 provided on the side wall of the grasping portion 11 concentrically to the suction tube 2. The material for the grip 3 may be a metal such as stainless steel or brass. When flexibility

is required for the grip 3, the similar synthetic resin to the grasping portion 11 such as polyurethane, polyester, polyethylene, polypropylene, polyamide, fluororesin, or silicone may be used, or a universal joint or flexible hose made of a rigid member such as a metal member may be used. The length of the grip 3 is not particularly limited but is preferably about 100 mm so that it does not interfere with a surgical operation.

【0012】

A description is subsequently given of CABG using the graft grasping device of the present invention with reference to Figs. 6 to 9.

First, the sternum is incised surgically to check the heart, after which a bypass graft (graft 4) is prepared. Thereafter, the anastomosing part of the coronary artery 5 which is seen on the surface of the heart is cut to make a hole 51 as shown in Fig. 7. Next, as shown in Fig. 6, the graft 4 is grasped by a graft grasping device BH and the negative pressure is applied to the lumen 111 of the grasping portion 11 by the suction device (not shown) connected to the suction tube 2. Then, the outer wall of the graft 4 is absorbed by the negative pressure and the anastomosing port 41 is opened. In this state, the graft 4 is sutured with the coronary artery 5 using a suture needle 6 (see Figs. 7 and 8). After the anastomosis, the slit 112 is opened to pull the graft grasping device BH in a direction indicated by an arrow "a" in order to remove it from the

graft 4. CABG is thus completed (see Fig. 9).

【0013】

【Effect of the Invention】

As is apparent from the above, if the graft grasping device of the present invention is adopted, a graft can be softly grasped by taking advantage of the suction force generated due to negative pressure, and at the same time, the anastomosing port of the graft serving as the bypass can be opened during a surgical operation. Therefore, anastomosis can be readily performed without causing damage to the intima of the graft.

【Brief Description of the Drawings】

【Fig. 1】 A front view of an embodiment of the present invention.

【Fig. 2】 A left side view of Fig. 1.

【Fig. 3】 An A-A cross sectional view of Fig. 1.

【Fig. 4】 An enlarged view of a main portion of Fig. 3.

【Fig. 5】 An enlarged B-B cross sectional view of Fig. 2.

【Fig. 6】 A diagram for explaining CABG using a graft grasping device of the present invention.

【Fig. 7】 A diagram for explaining CABG using the graft grasping device of the present invention.

【Fig. 8】 A diagram for explaining CABG using the graft grasping device of the present invention.

【Fig. 9】 A diagram for explaining CABG using the graft grasping device of the present invention.

【Description of Symbols】

1 graft grasping member

11 grasping portion

111 lumen

112 slit

113 communication port

114 recessed portion

115 portion adjacent to distal end and proximal end of grasping portion (margin)

116 portion adjacent to slit (margin)

117 stepped portion (margin)

12 suction tube connection portion

13 porous sheet

131 pore

14 mesh sheet

2 suction tube

21 lumen

22 connector

3 grip

4 graft

5 coronary artery

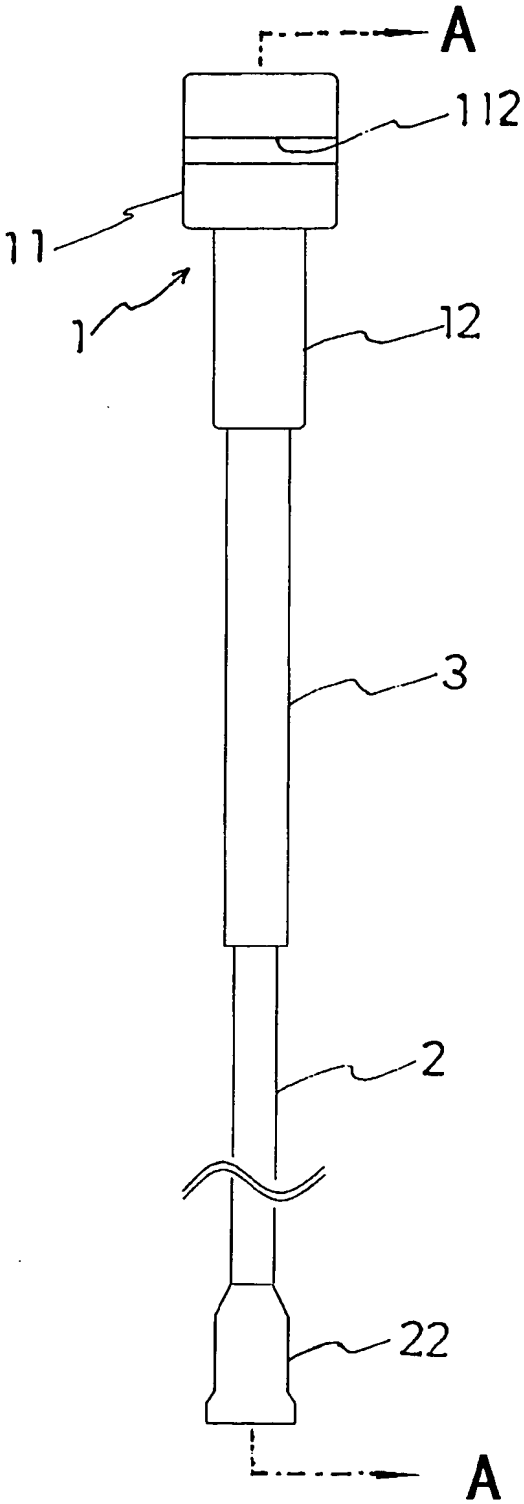
51 hole

6 suture needle

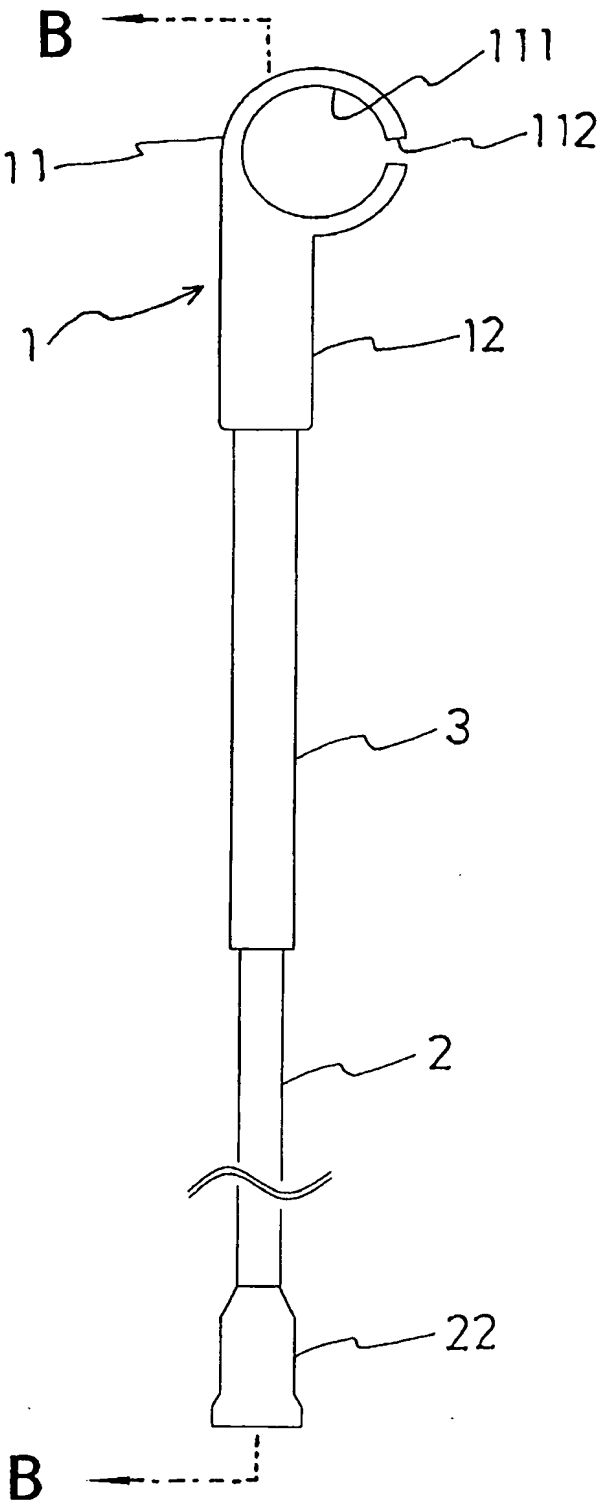
7 suture

BH graft grasping device

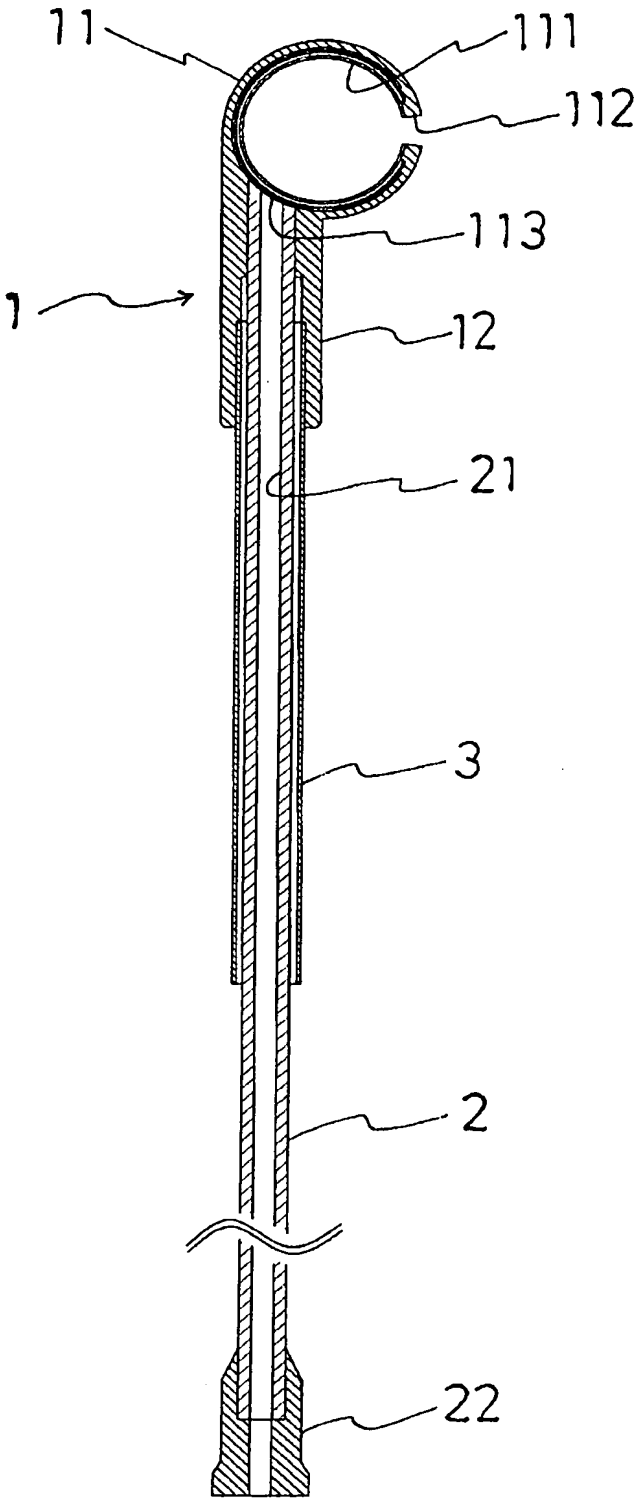
【Fig.1】



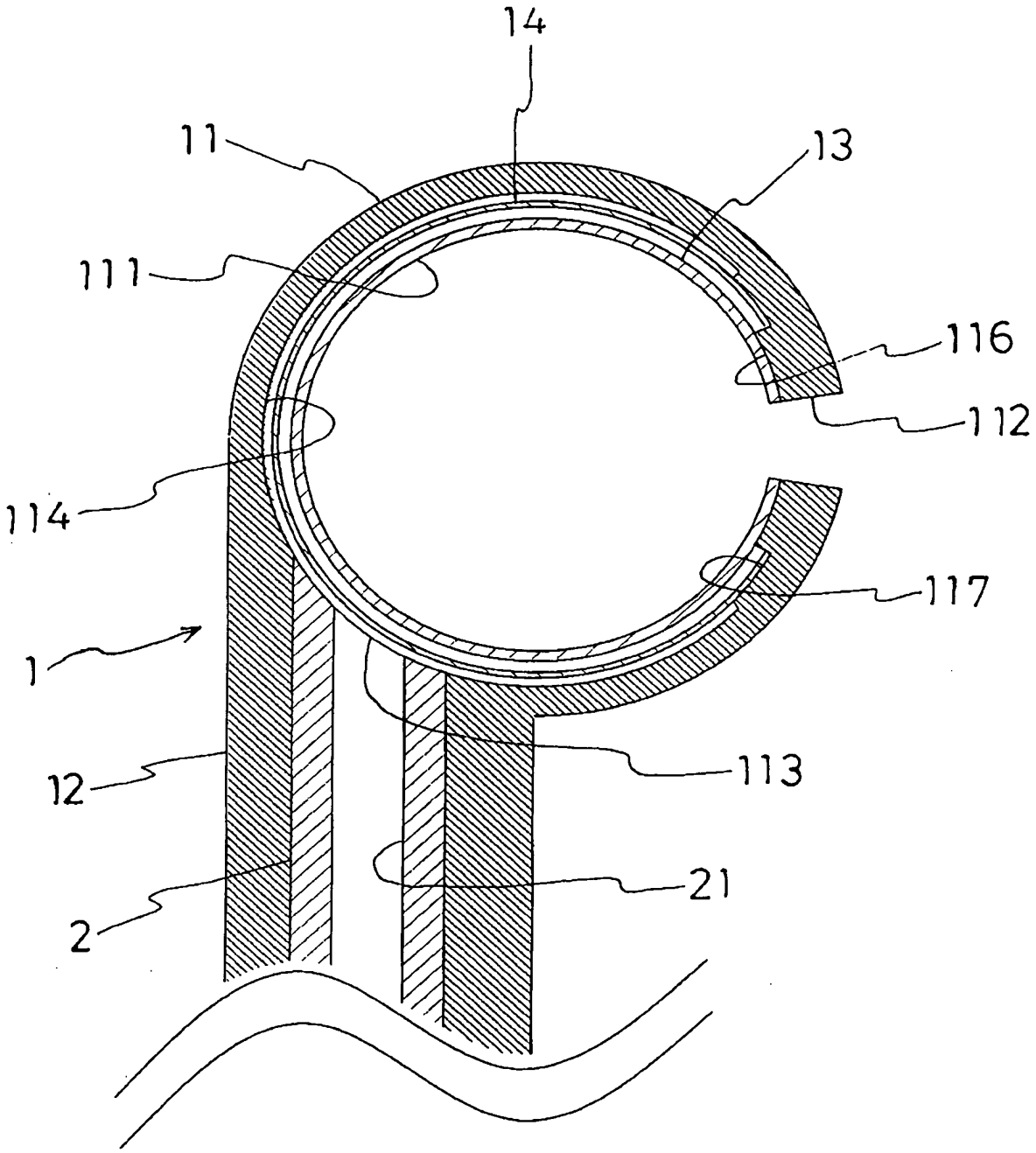
【Fig.2】



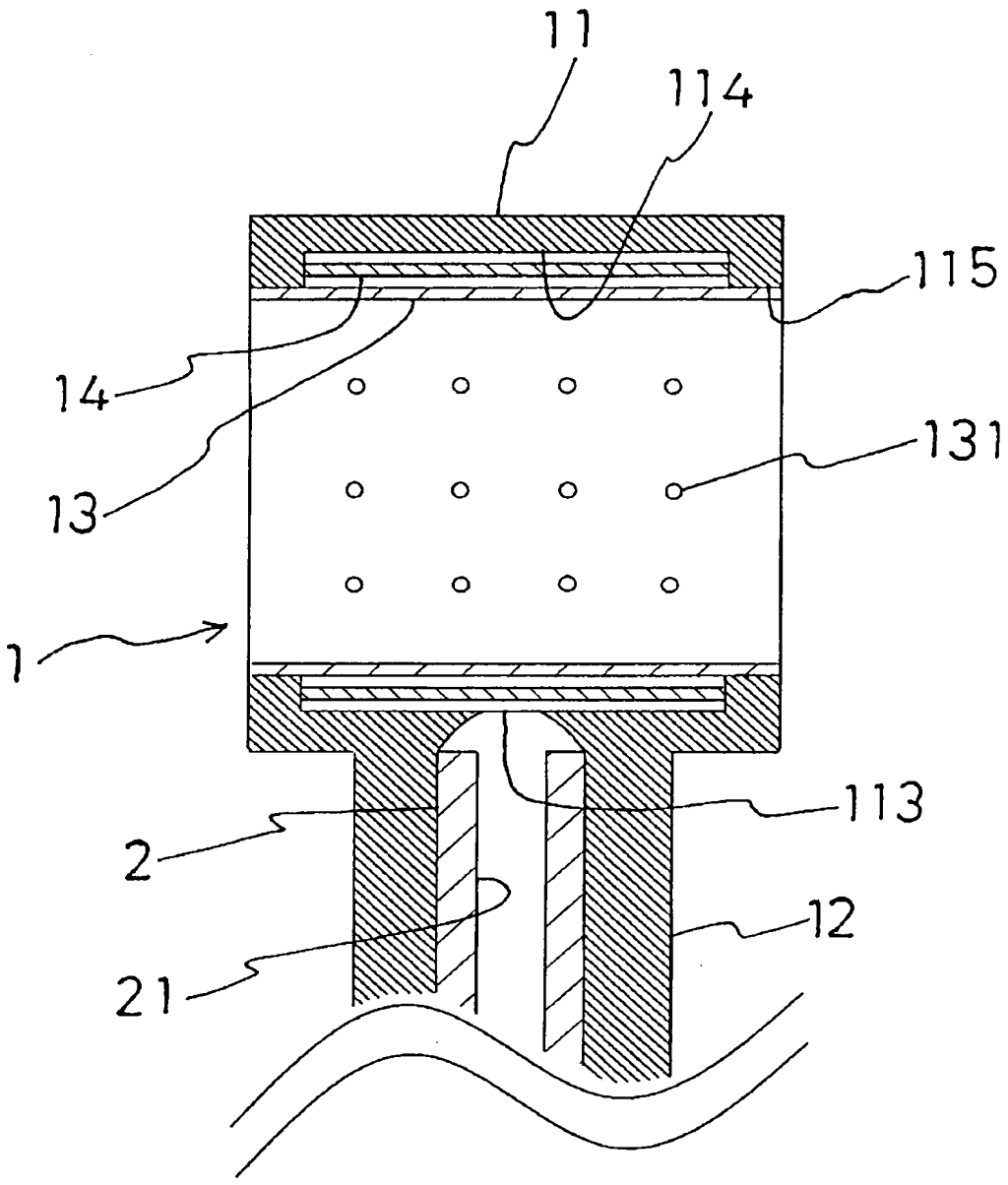
【Fig.3】



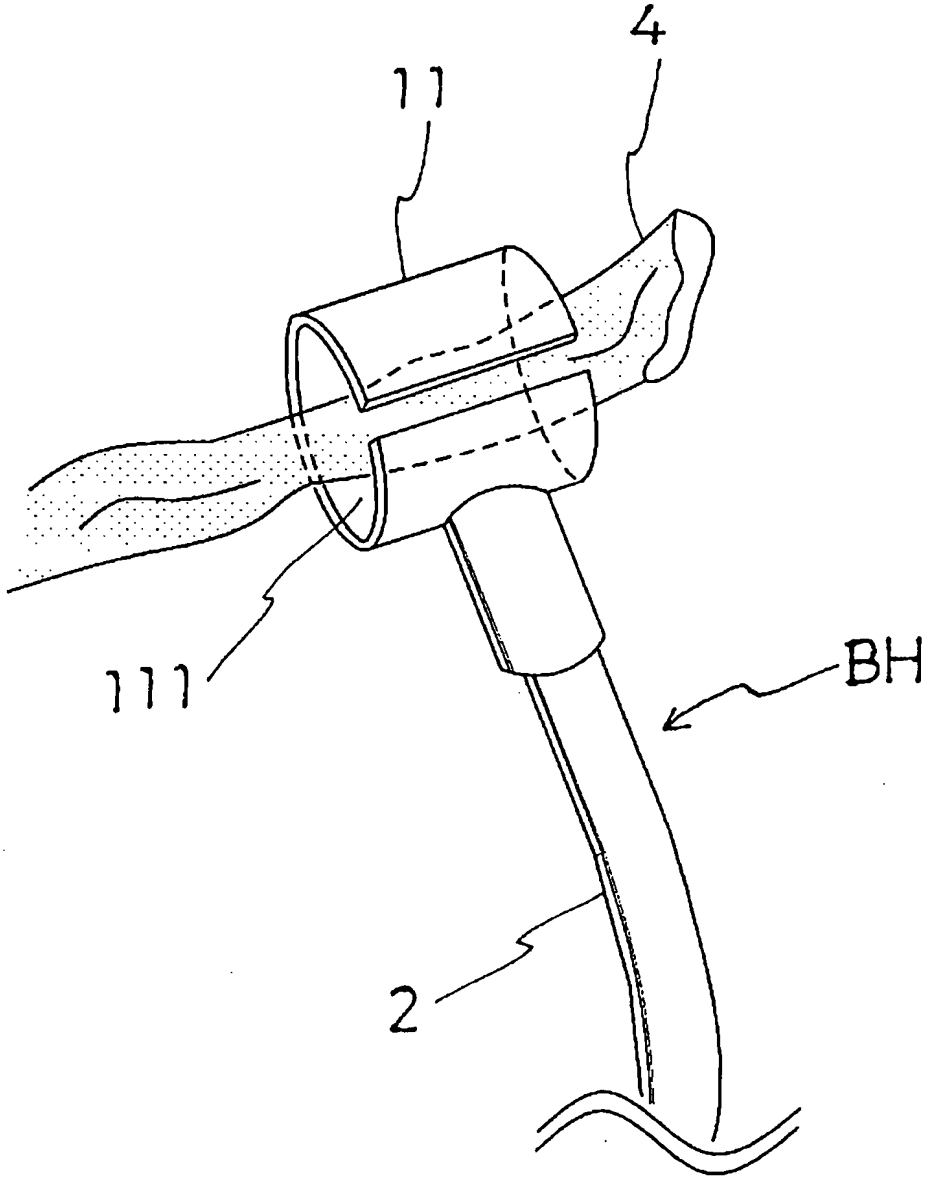
【Fig.4】



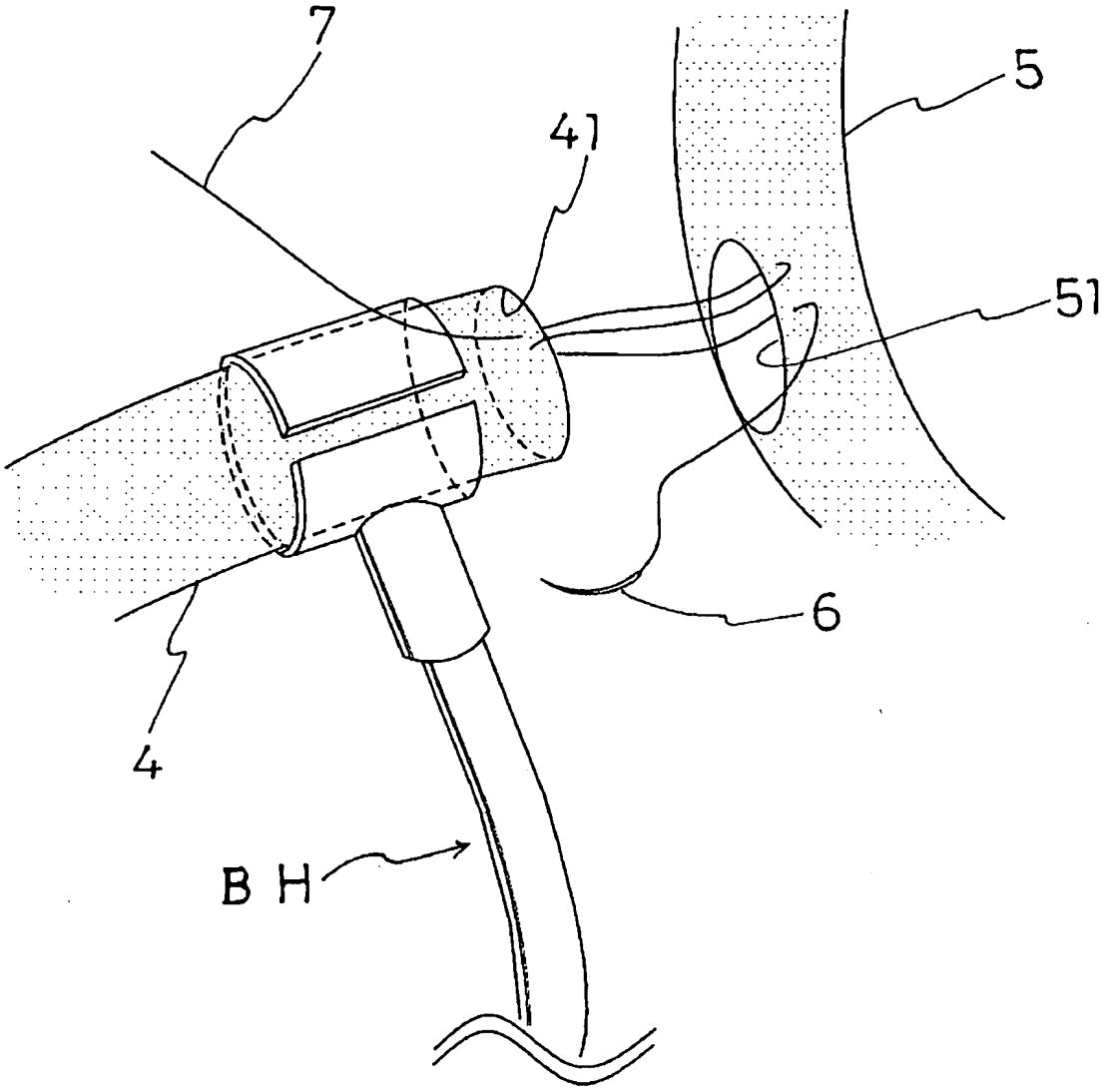
【Fig.5】



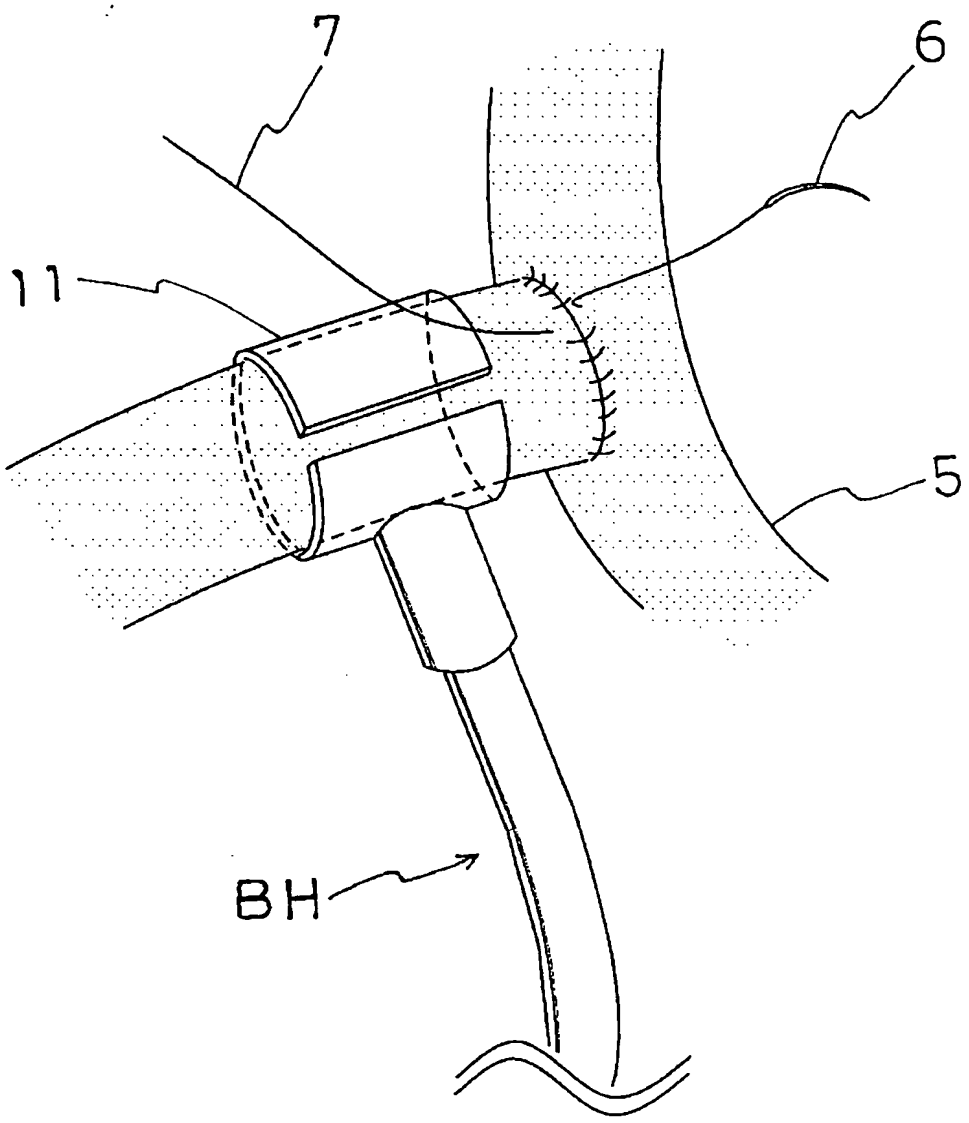
【Fig.6】



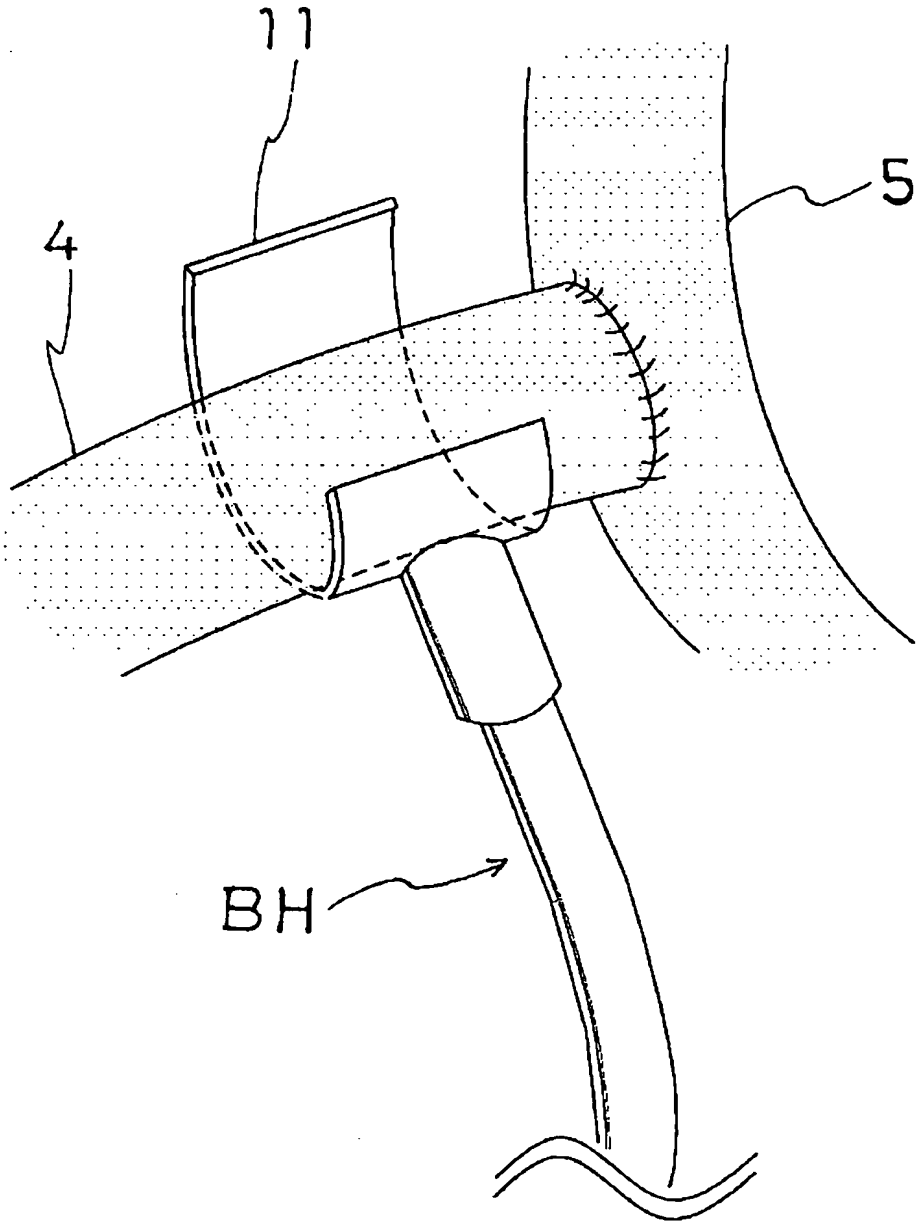
【Fig.7】



【Fig.8】



【Fig.9】



【Name of the Document】 Abstract

【Summary】

【Problem】 To provide a graft grasping device which can open an anatomosing port of a bypass graft to an anatomosing region without causing damage to an intima during a bypassing operation.

【Solving Means】 The graft grasping device includes a graft grasping member 1 including a soft tubular grasping portion 11 having a substantially C-shaped cross section and a suction tube 2 which communicates with a lumen 111 of the grasping portion 11 and is connected to a side wall of the grasping portion 11. A recessed portion 114 including at least a communication port 113 which communicates with a lumen 21 of the suction tube 2 and the lumen 111 of the grasping portion 11 is formed on an inner wall of the grasping portion 11. The recessed portion 114 is covered with a porous sheet 13 and a mesh sheet 14 is interposed between the recessed portion 114 and the porous sheet 13.

【Selected Drawing】 Fig. 4